

## Vinod K. Arya

### PUBLICATIONS

#### Journal

##### 2002

1. Structural Analyses of Stirling Power-Convertor Heater Head for Long-Term Reliability, Durability, and Performance\* (with Gary R. Halford, Ashwin Shah, David L. Krause, and Paul A. Bartolotta). Presented at Space Technology and Applications International Forum-STAIF Conference, Albuquerque, Feb. 2002.

##### 2001

2. NASA-GRC Fatigue Crack Initiation Life Prediction Models\* (with Halford, G. R.): Presented at the 5th Annual FAA/Air Force/NASA/Navy Workshop on the Application of Probabilistic Methods to Gas Turbine Engines, Holiday Inn Cleveland West, Westlake, 2001.

##### 1999

3. Thermal Strain Fatigue Modeling of a Matrix Alloy for a Metal Matrix Composite. **ASTM-STP 1371**. (Eds. Shitoglu and Maier), 1999.

##### 1998

4. Thermal Strain Fatigue Modeling of MMC's (with G. R. Halford and B. A. Lerch). **ASTM Symposium on Thermomechanical Fatigue Behavior of Materials, Norfolk, VA, November 4-5, 1998.**

##### 1996

5. Efficient and Accurate Explicit Time-Integration Algorithms with Application to Viscoplastic Models. **International Journal of Numerical Methods in Engineering, 39, pp. 261-279, 1996.**
6. Large Displacement Structural Durability Analyses of Simple Bend Specimen Emulating Rocket Nozzle Liners (with G. R. Halford and L. J. Westfall). **AIAA Journal of Propulsion and Power. 12, 1, 1996.**
7. Kinetics of Oxidation and Cracking and Finite Element Analyses of MA956 and MA956/Sapphire Composite System (with K. N. Lee, G. R. Halford and C. A. Barrett). **Metallurgical and Materials Transactions A, 27A, 3279-3291, Oct. 1996.**

##### 1995

8. Analyses of Oxide Layer Cracking Patterns of MA956 and MA956/Sapphire Composite Systems (with G. R. Halford). **Contemporary Research in Engineering Science** (ed. Batra, R.C.), pp. 41-54, Springer, 1995.

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\* Because of involvement of proprietary information, this research work is unpublishable in open literature.

9. Structurally-Compliant Rocket Engine Combustion Chamber - *Experimental/Analytical Validation* (with R.S. Jankovsky, J. M. Kazaroff, and G.R. Halford). **AIAA Journal of Spacecraft and Rockets**, 32,4, pp. 645-652, 1995.
10. Finite Element Analysis of Structural Engineering Problems Using a Viscoplastic Model Incorporating Two Back Stresses (with G. R. Halford). **ASME Journal of Engineering for Gas Turbines and Power**, 117, 2, pp. 377-383, 1995.

## 1992

11. Application of a Thermal Life Prediction Model to High-Temperature Alloys, B1900+Hf and Haynes 188 (with G.R. Halford, J.F. Saltsman and M.J. Verrilli). **American Society of Testing Materials, Special Technical Publication No. 1122, 1992.**
12. Nonlinear Structural Analysis of Cylindrical Thrust Chambers Using Viscoplastic Models. **AIAA Journal of Aerospace Propulsion and Power**. 8, 3, 598-604, 1992.
13. Viscoplastic Analysis of an Experimental Cylindrical Thrust Chamber Liner (with S.M Arnold). **AIAA Journal**, 30, 3, 781-789, 1992.
14. Thermomechanical and Low Cycle Fatigue Life Prediction of Metal Matrix Composites - A Local Stress-Strain Approach (with G. R. Halford). **Special Technical Publication No. 1122, American Society for Testing of Materials, pp 107-119, 1992.**
15. Reduction of Thermal Residual Stresses in Advanced Metallic Composites Based upon a Compensating/Compliant Layer Concept (with S. M. Arnold). **Journal of Composite Materials**. 26, 9, 1287-1309, 1992.

## 1991

16. An Elastic-Plastic-Creep and Life Analysis of a Cowl Lip (with G. R. Halford and M. E. Melis). **International Journal of Fatigue and Fracture of Engineering Materials & Structures**.9, 4, 201-208, 1991.
17. Application of Finite Element Based Solution Technologies for Viscoplastic Structural Analyses. **Communication in Applied Numerical Methods**.7, 435-444, 1991.
18. Finite Element Analysis of Structural Components Using Viscoplastic Models With Application to a Cowl Lip Problem (with G. R. Halford). **Journal of Materials at High Temperatures**. 9, 4, 201-208, 1991.

## 1989

19. Finite Element Implementation of Robinson's Unified Viscoplastic Model and Its Application to Some Uniaxial and Multiaxial Problems (with A. Kaufman). **Journal of Engineering Computations**, 6, 3, 237-247, 1989.
20. Analytical and Finite Element Solutions of Some Problems Using a Viscoplastic Model. **Journal of Computers and Structures**, 33, 4, 957-967, 1989.

## 1987

21. On the Creep Deformation, Bulge Behavior and Failure of Zircaloy Tubes. **Res Mechanica**. 20, 33-52, 1987.

## **1986**

22. Steady-State Creep of Orthotropic Rotating Disks of Variable Thickness (with N. S. Bhatnagar and P. S. Kulkarni). **Nuclear Engineering and Design. 91, 121-141, 1986.**
23. Creep Analysis of Orthotropic Rotating Cylinders Considering Finite Strains (with N. S. Bhatnagar and P. S. Kulkarni). **International Journal of Nonlinear Mechanics. 21, 61-71, 1986.**
24. Analysis of an Orthotropic Thick-Walled Cylinder Under Primary Creep Conditions (with N. S. Bhatnagar and P. S. Kulkarni). **International Journal of Pressure Vessels and Piping. 23, 165-185, 1986.**

## **1984**

25. Creep Analysis of An Internally Pressurized Orthotropic Rotating Cylinder (with N. S. Bhatnagar and P. S. Kulkarni). **Nuclear Engineering and Design. 83, 379-388, 1984.**

## **1983**

26. Creep Analysis of Orthotropic Circular Cylindrical Shells (with N. S. Bhatnagar and K. K. Debnath). **International Journal of Pressure Vessels and Piping. 11, 167-190, 1983.**

## **1980**

27. Creep of a Thin Orthotropic Circular Plate Containing a Hole at the Center (with N. S. Bhatnagar and K. K. Debnath). **Nuclear Engineering and Design. 56, 393-403, 1980.**
28. Creep Analysis of Orthotropic Rotating Cylinder (with N. S. Bhatnagar and K.K. Debnath). **Journal of Pressure Vessel Technology. 102, 371-377, 1980.**
29. The Spherical Vessel With Anisotropic Properties Considering Large Strains (with N. S. Bhatnagar and K.K. Debnath). **International Journal of Nonlinear Mechanics. 15, 185-193, 1980.**

## **1979**

30. Creep Analysis of Rotating Orthotropic Disks (with N. S. Bhatnagar). **Nuclear Engineering and Design. 55, 323-330, 1979.**

## **1977**

31. Creep Analysis of Pinjointed Frameworks (with N. S. Bhatnagar and K.K. Debnath). **Indian Journal of Technology. 18, 518-519, 1977.**

## **1976**

32. Creep of Thick-Walled Orthotropic Cylinders Subject to Combined Internal and External Pressures (with N. S. Bhatnagar). **Journal of Mechanical Engineering Science. 18, 1-5, 1976.**

33. Creep Deformation of Symmetrically Loaded Shells of Revolution Under Tresca Yield Criterion and Mises Flow Rule (with N. S. Bhatnagar and S. Kumar). **Journal of Structural Engineering. 4, 77-86, 1976.**

#### **1975**

34. Creep of Thick-Walled Spherical Vessels Under Internal Pressure Considering Large Strains (with N. S. Bhatnagar). **Indian Journal of Pure and Applied Mathematics. 6, 1080-1089, 1975.**

#### **1974**

35. Anisotropic Creep Under Combined Tension and Torsion (with N. S. Bhatnagar). **Journal of the Aeronautical Society of India. 26, 101-103, 1974.**
36. Large Strain Creep Analysis of Thick-Walled Cylinders (with N. S. Bhatnagar). **International Journal of Nonlinear Mechanics. 9, 127-140, 1974.**

#### **1973**

37. Nonsteady Membrane Creep of Anisotropic Circular Plates (with N. S. Bhatnagar). **Journal of the Physical Society of Japan. 35, 1212-1217, 1973.**

### **Books/Manuals**

#### **2003**

1. **FLAPS (Fatigue Life Analysis Programs)** – Computer Programs to Predict Cyclic Life Using the Total Strain Version of StrainRange Partitioning and Other Life Prediction Methods. Users' Manual and Example Problems. Version 1.0, 2003.

#### **1976**

2. **Introduction to Matrix Algebra.** (Written Under Curriculum Development Program, Government of India, 1976-77).

### **NASA Technical Reports**

#### **2004**

1. Durability Assessment of Gamma TiAl – Final Report. (with Susan L. Draper, Bradley A. Lerch, Michael Pereira, Kazuhisa Miyoshi and Wyman Zhuang). **NASA TM-212303, 2004.**

#### **2002**

2. Structural Analyses of Stirling Power Converter Heater Head for Long-Term Reliability, Durability, and Performance. **NASA-TM-2—2-211327, April 2002.**

#### **1994**

3. Large Displacement Structural Durability Analyses of Simple Bend Specimen Emulating Rocket Nozzle Liners (with G. R. Halford). **NASA TM 106521, June 1994.**
4. Efficient and Accurate Explicit Time-Integration Algorithms with Application to Viscoplastic Models. **NASA CR 195342, August 1994.**

#### **1993**

5. Structurally-Compliant Rocket Engine Combustion Chamber - Experimental/Analytical Validation (with R. Jankovsky, J. M. Kazaroff and G. R. Halford). **NASA TP-3431, 1993.**
6. Finite Element Analysis of Structural Engineering Problems Using a Viscoplastic Model Incorporating Two Back Stresses (with G. R. Halford). **Proceedings of Int. Seminar on Inelastic Analysis, Fracture and Life Prediction, Paris, France, 1993 and NASA TM-106046, 1993.**

#### **1991**

7. Elastic/Plastic Analyses of Advanced Composites Investigating the Use of the Compliant Layer Concept in Reducing Residual Stresses Resulting from Processing (with S. M. Arnold). **NASA Technical Memorandum, 103204, 1991.**

#### **1990**

8. Finite Element Elastic-Plastic-Creep and Cyclic Life Analysis of a Cowl Lip (with Gary R. Halford and M. E. Melis). **NASA TM- 102342, 1990.**
9. Application of Finite-Element-Based Solution Technologies for Viscoplastic Structural Analyses. **NASA CR-185196, 1990.**
10. Finite Element Analysis of Structural Components Using Viscoplastic Models With Application to a Cowl Lip Problem (with G. R. Halford). **NASA CR-185189, 1990.**
11. Application of a Thermal Life Prediction Model to High-Temperature Alloys, B1900+Hf and Haynes 188 (with G.R. Halford, J.F. Saltsman and M.J. Verrilli). **NASA TM-4226, 1990.**
12. Nonlinear Structural Analysis of Cylindrical Thrust Chambers Using Viscoplastic Models. **NASA CR-185253, 1990.**
13. Viscoplastic Analysis of an Experimental Cylindrical Thrust Chamber Liner (with S. M. Arnold). **NASA Technical Memorandum, 1990.**

#### **1989**

14. Analysis of Damage in MMC Components Using an Internal State Variable Model. **NASA CP -10030, 53-58, 1989.**

#### **1988**

15. Analytical and Finite Element Solutions of Some Problems Using a Viscoplastic Model. **NASA Technical Memorandum, 1988.**

#### **1987**

16. Finite Element Implementation of Viscoplastic Models (with A. Kaufman). **NASA CP-2493, pp. 335-248, 1987.**

## Conference Proceedings and Presentations

### 1998

1. Finite Element Analysis of Structural Engineering Problems Using an Advanced Viscoplastic Model (with G. R. Halford). **Proceedings of the 3<sup>rd</sup> Biennial Engineering Mathematics and Analysis Conference (EMAC '98)**, Adelaide, Australia, (Eds: E.O. Tuck and J.A.K. Stott), 1998, pp. 91-94.
2. Large-Displacement Creep Analysis of Simple Bend Specimen Emulating Rocket Nozzle Liners (with N. S. Bhatnagar). **International Symposium on Inelastic Deformation, Damage and Life Analysis '98. (ICES '98)**, Oct 6-9, Atlanta, 1998.

### 1997

3. Thermal Fatigue Limitations of Continuous Fiber Metal Matrix Composites (with G. R. Halford). **Physics and Process Modeling (PPM) and other Propulsion R&T Conference. NASA CP-10193, Vol. 1, Paper 19, NASA Lewis Research Center, Cleveland, OH, May 1, 1997, PP. 1-11.**
4. Advanced Viscoplastic Structural and Cyclic Life of a Cowl Lip (with G. R. Halford). International Symposium on Inelastic Deformation, Damage and Life Analysis '97, **Advances in Computational Engineering Science, ICES '97**, Eds. S.N. Atluri and Y.G. Yagawa, San Jose, Costa Rica, May 4-9, 1997, pp. 2-7.
5. Thermal stresses – the Achilles' Heal of Continuous Fiber Reinforced Metal Matrix Composites (with G. R. Halford). **Thermal Stresses '97. Proceedings of the Second International Symposium on Thermal Stresses and Related Topics, Rochester Institute of Technology, NY, June 8-11, 1997, pp. 41-44.**

### 1995

6. Analyses of Oxide Layer Cracking Patterns of MA956 and MA956/Sapphire Composite Systems (with G. R. Halford). **Proceedings of Recent Developments in Engineering Science, New Orleans, Oct.- Nov. 1995.**
7. Large Displacement Structural Durability Analysis of Simple Bend Specimen Emulating Rocket Nozzle Liners (with G. R. Halford). **Computational Mechanics '95, Theory and Applications.** (Eds. Atluri, Yagawa and Cruse), pp. 1285-1291, 1995.

### 1994

8. Kinetics of Oxidation and Cracking and Finite Element Analyses of MA 956 and MA 956/ Sapphire Composite Systems. Part I – Experimental (with K. N. Lee, G. R. Halford and C. A. Barrett). **NASA-HITEMP Proceedings, 1994.**
9. Kinetics of Oxidation and Cracking and Finite Element Analyses of MA 956 and MA 956/ Sapphire Composite System. Part II – Analytical (with K. N. Lee, G. R. Halford and C. A. Barrett). **NASA-HITEMP Proceedings, 1994.**

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10. Finite Element Analysis of Structural Engineering Problems Using a Viscoplastic Model Incorporating Two Back Stresses (with G. R. Halford). **Proceedings of Int. Seminar on Inelastic Analysis, Fracture and Life Prediction, Paris, France, 1993 and NASA TM-106046, 1993.**

### 1992

11. Application of Viscoplastic Models in the Finite Element Analyses of Structural Engineering Problems. (with G. R. Halford). **Computational Mechanics '92.** (Editors: Atluri et al.).
12. Life Assessment of Structural Components Using Inelastic Finite Element Analyses (with G. R. Halford). **Proceedings of the Workshop on Computational Methods for Failure Analysis and Life Prediction.** NASA-Langley Research Center, Hampton, Virginia, 1992.

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13. Reduction of Thermal Residual Stresses in Advanced Metallic Composites by Application of a Compensating/Compliant Layer Concept (with S. M. Arnold). **Proceedings of HITEMP Conference, Lewis Research Center, Cleveland, OHIO, USA, 1990.**

### 1989

14. Structural Response of SSME Turbine Blade Airfoils (with A. A. Aziz and R. L. Thompson). **Proceedings of the Earth-to-Orbit Conference, NASA Marshall Space Flight Center, Huntsville, Alabama, 1989.**
15. Finite Element Analysis of Structural Components Using Viscoplastic Models. **Proceedings of Second International Conference on Computational Plasticity, Barcelona, 1989.**

### 1988

16. Finite Element (MARC) Solution Technologies for Viscoplastic Analyses (with R. L. Thompson). **Proceedings of Conference on Lewis Structures' Technology, Cleveland, USA, pp. 73-79, 1988.**
17. Finite Element Implementation of Viscoplastic Models and Its Application to Nonlinear Structural Analyses (with A. Kaufman). **Proceedings of International Conference on Engineering Sciences, Atlanta, USA, 1988.**

### 1985

18. Analysis of Local Inelastic (Ballooning) Behavior and Time-to-Failure of Zircaloy Claddings. **Transactions of the 8th International Conference on Structural Mechanics in Reactor Technology. Brussels, Belgium, Paper No. C-2/4, 1985.**

### 1988

19. Finite Element Analysis of Metal-Matrix Composite Structures (with D. N. Robinson). **Proceedings of ASME/ SES Symposium on "Constitutive Equations**

**for Life Prediction Models for High Temperature Applications", Berkeley, CA, 1988.**

**1987**

20. Numerical Integration and Implementation of Viscoplastic Models into Finite Element Codes.(with K. Hornberger, H. Stamm and W. Huber). **Proceedings of International Conference on Computational Plasticity, Barcelona, Spain, 1987.**
21. On the Integration of Viscoplastic Models and Its Application for Stress Analysis in Thick-Walled Cylinders (with K. Hornberger, H. Stamm). **Proceedings of 9th International Conference on Structural Mechanics in Reactor Technology, Lausanne, Switzerland, 1987.**

**1986**

22. Primary Creep Analysis of an Anisotropic Thick-Walled Spherical Shell (with N. S. Bhatnagar and P. S. Kulkarni). **Proceedings of Workshop on Continuum Mechanics, Roorkee, 1986.**
23. On the Integration of Unified Viscoplastic Models (with K. Hornberger and H. Stamm). **Kernforschungszentrum Karlsruhe, West Germany, Report No. KfK-4082, 1986.**
24. Untersuchungen zum Viscoplastischen Materialverhalten im Hochtemperatur Bereich (with K. Hornberger and H. Stamm). **Kernforschungszentrum Karlsruhe, Report, 1986.**

**1985**

25. Creep Analysis of Thin-Walled Anisotropic Cylinders Subjected to Internal Pressure, Bending and Twisting (with N. S. Bhatnagar and P. S. Kulkarni). **Proceedings of Workshop on Solid Mechanics, Roorkee, 1985.**

**1981**

26. An Analytical Model for the Analysis of Ballooning Behavior of Zircaloy Claddings. **Kernforschungszentrum Karlsruhe, Report, 1981.**
27. Creep Analysis of a Rotating Disk Using a Strain Hardening Law (with N. S. Bhatnagar). **Proceedings of the National Academy of Sciences, India, 1981.**